Space Weather Technical Forecast

Issued on Friday, 29 July 2022 at 13:09 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Storm intervals days 2 and 3 (30th and 31st).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with an impulsive C4 flare at 29/0432UTC, originating from AR3068 in the southeast quadrant. There are currently three sunspot regions on the visible disc. AR3038 has grown rapidly in the last 24 hours, and is now the largest and most magnetically complex region on the disc, and produced the aforementioned C4 flare. This is now classified as a Dai/Beta-Gamma. The other two sunspot regions are small and stable. AR3066 has faded to plage. There was a small filament lift-off in the southern hemisphere around 28/2200UTC, which produced a very faint CME seen in coronagraph imagery at 29/0125UTC, which is yet to be analysed for any potential Earth-directed component. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR at L1, were predominantly at background levels, between 340-400 km/s. Density was mainly at average levels. The interplanetary magnetic field (IMF), Bt, was mostly weak, with the north-south component, Bz, fluctuating between +7nT to -4nT. The Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16 was at Background levels. The High energy electron flux (greater than 2MeV) varied between Background and Moderate levels, with a brief peak of 1000pfu observed at 28/1525 UTC. Electron fluence showed a declining trend, remaining well below the Active threshold (1e8 integrated flux), with an observed fluence of 2.28e7 integrated pfu recorded at 29/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain predominantly Low with only a slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: No CMEs have been assessed as Earth-directed. Solar winds are expected to be slow-ambient initially, before the arrival of the fast wind of CH04 late on day 2 (30th), enhancing solar winds to around 500km/s for days 3 and 4 (31st July and 1st August). Geomagnetic activity is forecast to be mainly Quiet (Kp 0-2) with a chance of Unsettled intervals (Kp 3), then to become Unsettled and Active (Kp 3-4) with a slight chance of G1/Minor storm (Kp 5) from late on day 2 (30th) into day 3 (31st). Becoming mostly Quiet to Unsettled on day 4 (1st August).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at Background levels. The high energy electron flux (greater than 2 MeV) is expected to remain mostly at Background and Moderate levels, with the corresponding 24 hour fluence remaining below the Active threshold (1e8 integrated pfu).

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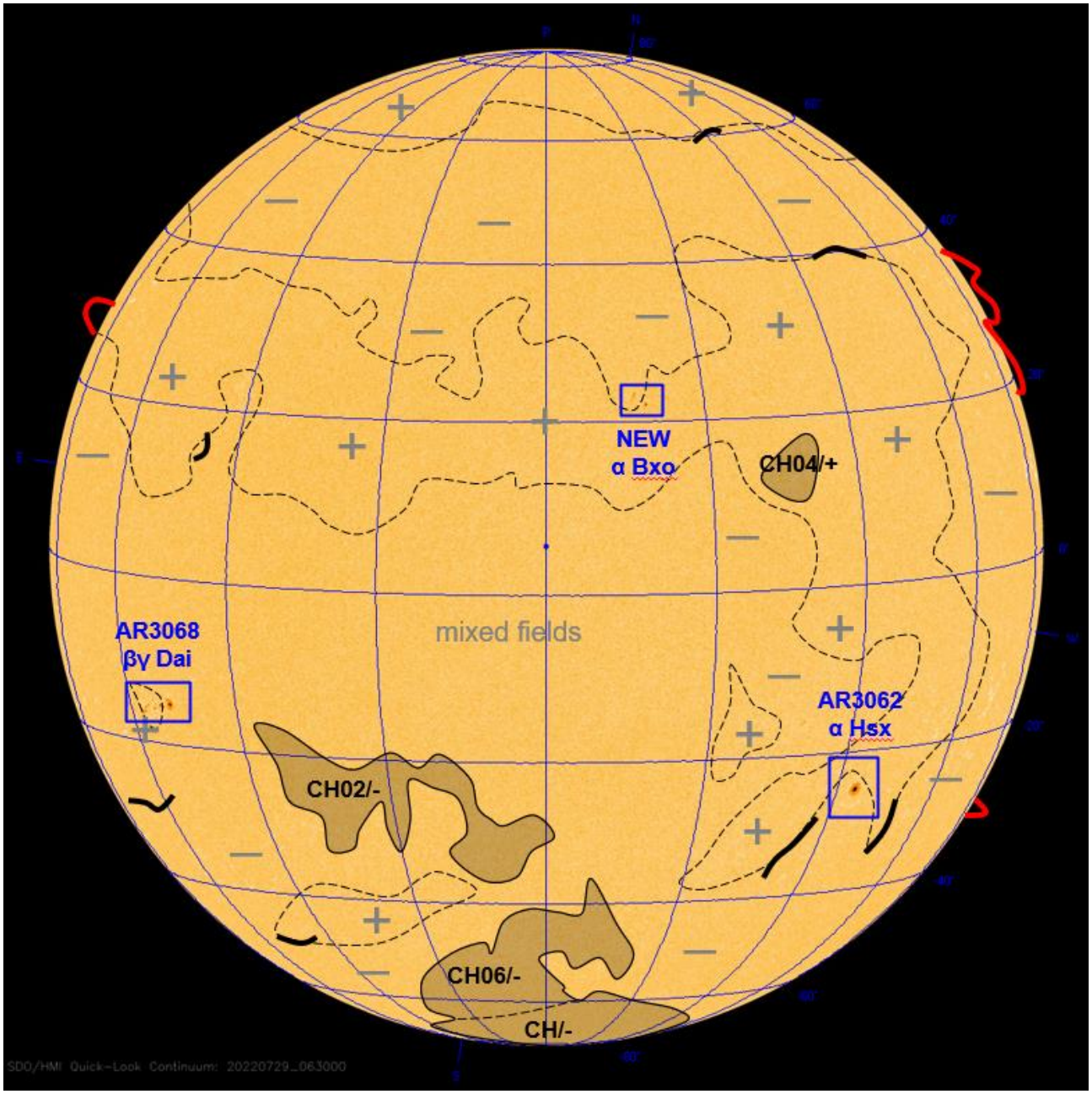
Figure 1. Solar Analysis Valid 29/0630UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

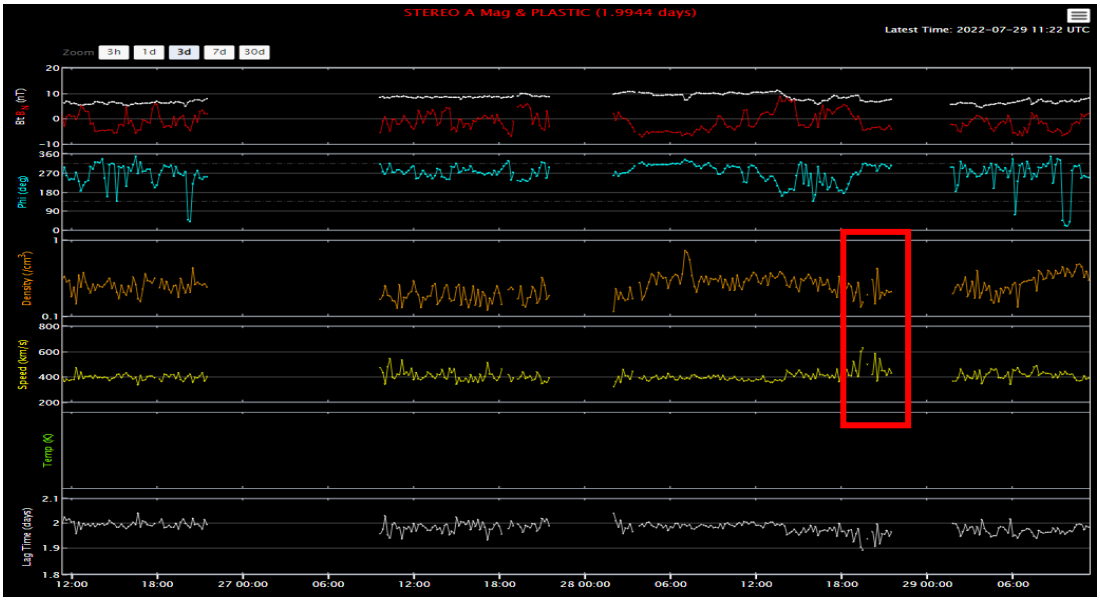
No CMEs have been assessed as Earth-directed for this period.

Solar winds are currently close to slow-ambient levels, near 370km/s, with no significant enhancements expected in the next 24 hours. The next coronal hole worth of note is CH04/+. It is not a recurring feature so persistence cannot be relied upon. However, data obtained from Stereo A Mag & Plastic indicates that the HSS may have arrived there, which would suggest an arrival of the HSS at Earth late tomorrow (30th). Based on the coronal hole dimensions, estimated solar wind speeds would be around 500km/s. Enlil suggested a notable enhancement on the 28th, which is has not occurred.

Geomagnetic activity is forecast to be mainly Quiet (Kp 0-2) with a chance of Unsettled intervals (Kp 3), then to become Unsettled and Active (Kp 3-4) with a slight chance of G1/Minor storm (Kp 5) from late on day 2 (30th) into day 3 (31st). Becoming mostly Quiet to Unsettled on day 4 (1st August).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	30	20	5
Strong	G3	No	1	2	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: STEREO A Mag and Plastic within the solar wind show indications that the HSS from CH04 may have arrived, albeit a fairly weak feature.


STEREO A Mag & PLASTIC (1.9944 days)
Latest Time: 2022-07-29 11:22 UTC
Zoom 3h 1d 3d 7d 30d
Bt, Bz (nT)
Phi (deg)
Density (/cm³)
Speed (km/s)
Temp (K)
Lag Time (days)
12:00 18:00 27 00:00 06:00 12:00 18:00 28 00:00 06:00 12:00 18:00 29 00:00 06:00

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Radio Blackouts - X-Ray Flares:
Solar activity has been Low over the past 24 hours, with an impulsive C4 flare at 29/0430UTC, originating from AR3068 in the southeast. Activity is likely to be Low, with increased Chance of C-class flares, and only a Slight Chance of Moderate flares, mainly from AR3068.

There are currently three sunspot regions on the visible disc, one of which is currently unnumbered in the northwest quadrant. However, they are all small and magnetically simple. AR3068 in the southeast continues to grow in size and is becoming more magnetically complex as it develops, with rudimentary spots visible in the trailing spots. This is now classified as a Dai/Beta-Gamma.

Far-sided products give a potential for further regions to rotate onto the disc over coming day or two. However, confidence is low regarding the size and activity associated with the regions. Predominantly Low activity is expected through the period, with only a slight chance of rising to Moderate due to any M-class flares (R1 Radio Blackouts).

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: SDO AIA 94 shows the C4 flare originating from AR3068

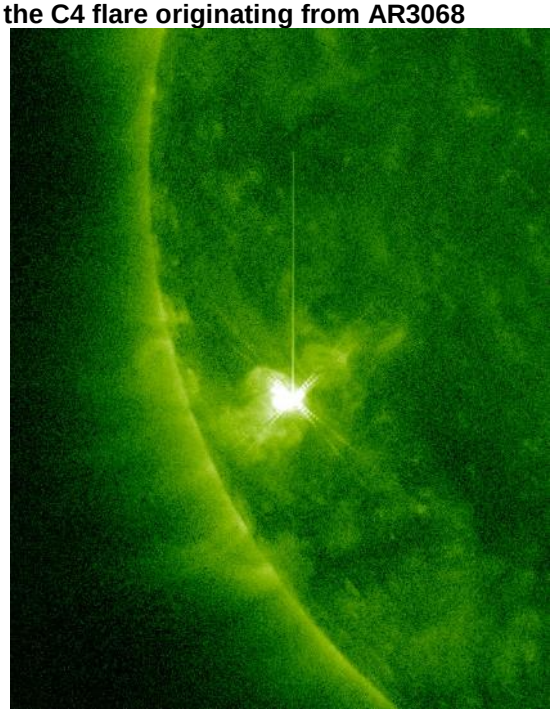

Figure 4: GOES-16 X-Ray flares.

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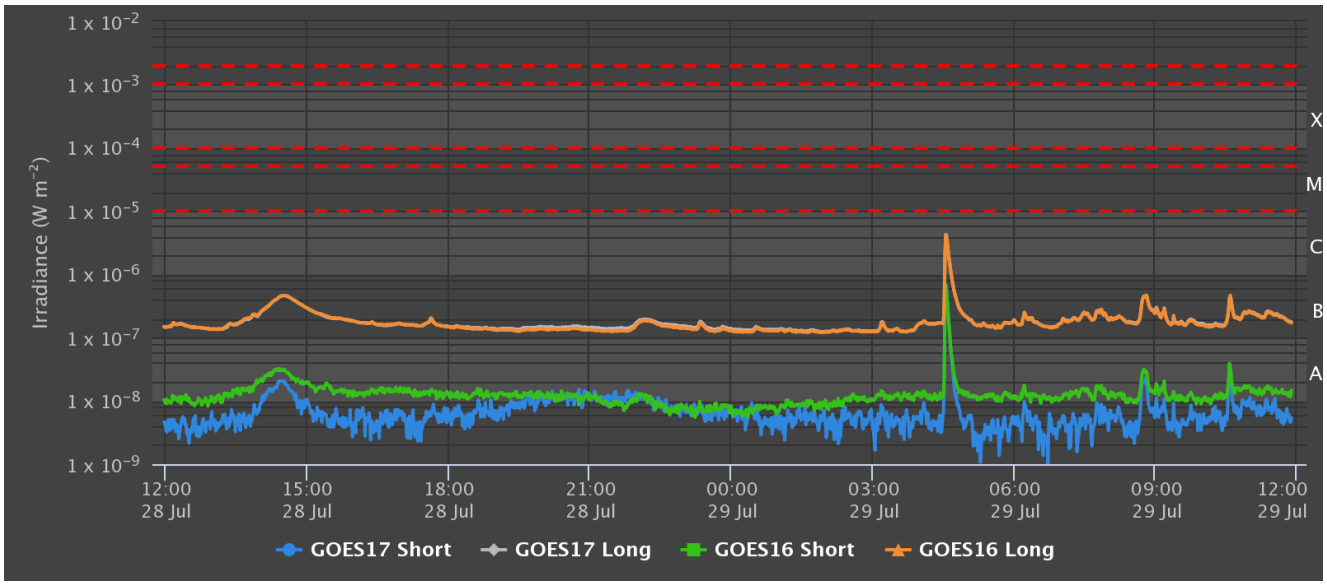

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels and is currently expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

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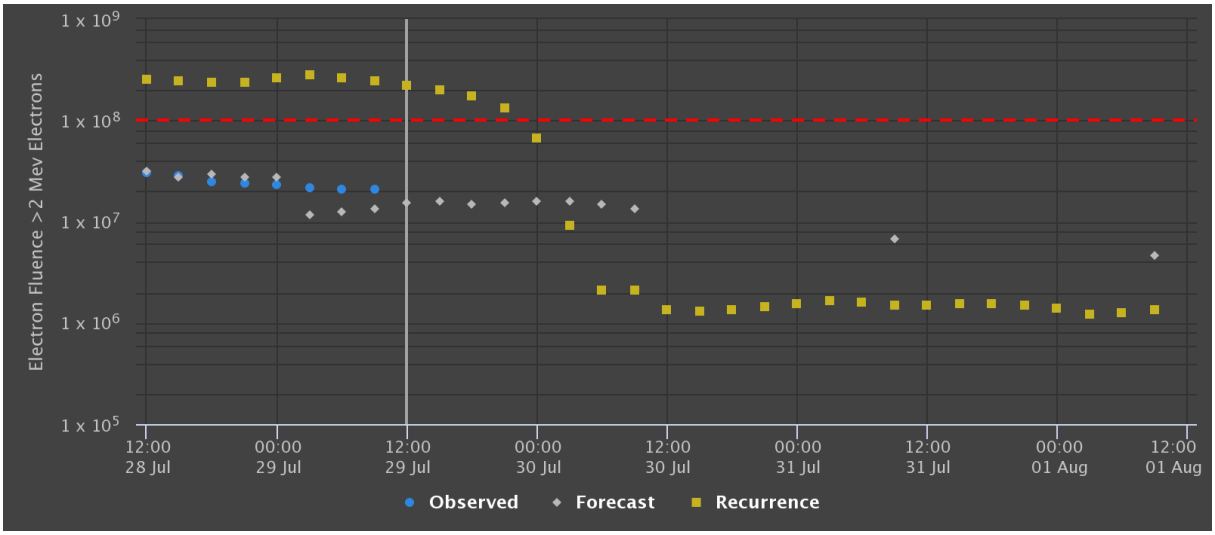
The high energy electron flux (greater than 2MeV) is expected to continue fluctuating between background and moderate levels, with a chance of exceeding the High threshold during day 4, after the arrival of the HSS from CH04.

The corresponding 24-hour fluence is expected to remain below the Active threshold through the period. This is supported by the REFM output.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: REFM electron fluence.



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